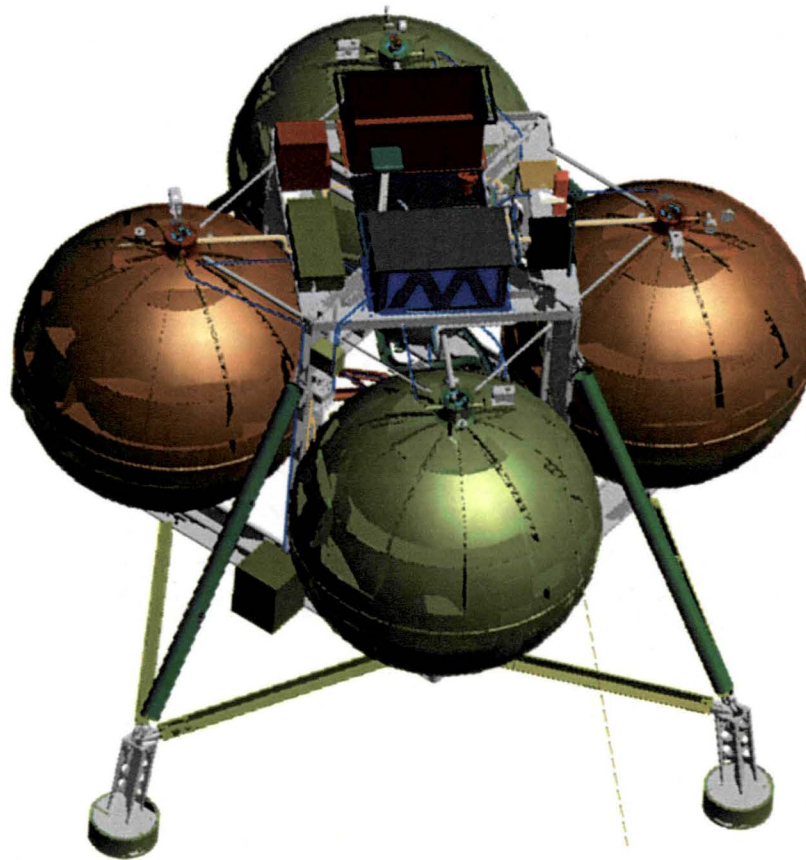


**Proposed Draft Ground Safety
Requirements for Flight Metallic
Pressure Vessels for Inclusion in AIAA
S-080**

Morpheus

Lunar lander prototype vehicle designed for a terrestrial vertical test bed



SAFETY REQUIREMENTS FOR DESIGN, TEST, AND GROUND PROCESSING OF FLIGHT METALLIC PRESSURE VESSELS (FMPVs) AT THE KENNEDY SPACE CENTER (KSC)

a. The hardware provider shall verify that the design, qualification, and acceptance testing of the FMPV complies with the requirements of ANSI/American Institute of Aeronautics and Astronautics (AIAA) S-080 Metallic Pressure Vessels, Pressurized Structures, Pressure Components and Special Pressurized Equipment or another industry recognized standard for FMPVs.

b. Prior to the first pressurization of a **FMPV** at KSC an inspection of the vessel for visible damage shall be performed by a trained inspector. ~~The trained inspector's skills shall be comparable to a Level II visual inspector, per the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A (see ANSI/AIAA S-081A-2006, Paragraph 5.5.3).~~ The Inspector must be trained in the specific inspection of **FMPVs**. This training must address the types of damage that can occur the effects of that damage, and disposition of damage indications. Currently this training is conducted by NASA White Sands Test Facility.

Or Trained Inspector: (FMPV) A person trained specifically in the detection of visual damage of FMPVs and familiarized with the NDE methods and results that could be used to aid in the interpretation of visual damage. White Sands Test Facility typically conducts this training as part of their FMPV damage control and inspection course.

If this inspection is not possible at the launch site (i.e. FMPV is not accessible), then it shall be conducted the last time the FMPV is accessible for inspection.

(JBH Note We have not yet been able to create wording that would could apply both to NASA and non NASA Aerospace companies)

c. *JBH note: What data for a flight metallic PV should KSC request equivalent to a COPV Mechanical damage control plan?? Think about the Morpheus tank*

a) fracture control plan

b) weld inspection report

c) Is the PV LBB non hazardous fluid or Brittle or LBB Hazardous?

Proposed FMPV Ground Processing Requirements

d. If FMPVs are to be pressurized at KSC to pressures greater than one ~~third~~ half of the FMPVs design burst pressure, the pressurizations shall be performed remotely, ensuring ground personnel safety, or a blast shield shall be used to protect personnel. If the vessel is to remain pressurized, personnel access shall not be permitted to the area for at least ten (10) minutes after pressurization is completed.

JBH Note Is $\frac{1}{2}$ design burst pressure the correct parameter that KSC should use to determine clears and if a blast analysis is needed?

Proposed FMPV Ground Processing Requirements

- e. Personnel limits for each operation on or near the FMPV/Spacecraft shall be established to minimize personnel exposure to the pressurized tank when at pressures greater than one ~~third~~ half design burst pressure.
- f. If the FMPV is pressurized above **1/2 design burst pressure**, the safety clear distance during pressurization and the post pressurization personnel access controls shall be determined by a FMPV blast/fragmentation analysis.
- g. The transport of pressurized FMPVs at pressures greater than one half design burst pressure shall be along routes that minimize exposure to personnel and facilities with escort during designated “off-shift” time periods.

Proposed FMPV Ground Processing Requirements

h. Hardware providers shall develop Emergency Response Plans (ERPs) that include contingency safing and backout plans for FMPVs. The ERPs shall consider leaks, impact damage to the FMPV that requires immediate action, and exposure to hazardous materials. If implemented, a real-time assessment shall be accomplished and contingency operations taken as required. The ERP shall be approved prior to the start of ground operations by the applicable NASA Safety organization.

- **Add definition of design burst pressure per AIAA S-080**

Design Burst Pressure: A pressure that the pressurized hardware must withstand without

- rupture in the applicable operating environment. It is equal to the product of the MEOP and a burst factor.